

Patent Claims:

1. A hydraulic vehicle brake equipped with a parking brake device, in particular for motor vehicles, including a brake housing in which a hydraulic service pressure chamber is delimited by a brake piston, with the parking brake device acting on the brake piston and, in the applied condition, being lockable by means of a locking device, and an energy accumulator cooperating with the brake piston being equipped with at least one integrated spring element,
c h a r a c t e r i z e d in that the parking brake device is operable by a pressure that is introduced into the service pressure chamber (7) and enables charging the energy accumulator (10).
2. Hydraulic vehicle brake as claimed in claim 1,
c h a r a c t e r i z e d in that the energy accumulator (10) is formed of a recess (11) in the brake piston (6) accommodating the spring element (12), and in that the spring element (12) is supported on a plate (13) that is in a force-transmitting connection with the brake piston (6) and cooperates with a first friction lining (3).
3. Hydraulic vehicle brake as claimed in claim 2,
c h a r a c t e r i z e d in that the locking device is a threaded-nut/spindle assembly (14), the threaded nut (15) thereof being supported on the brake piston (6) or being integrally designed with the brake piston (6), while the spindle (16) includes a first friction surface (17) interacting, in the locked condition, with a second friction surface (18) that is arranged in an unrotatable manner in the brake housing (1).

4. Hydraulic vehicle brake as claimed in claim 3,
c h a r a c t e r i z e d in that the spindle (16) is
equipped with an axial central bearing (21), which
cooperates with a hydraulic or electromechanical device
(22, 27, or 35, respectively) for activating the locking
device (14).
5. Hydraulic vehicle brake as claimed in claim 4,
c h a r a c t e r i z e d in that the hydraulic device
(22, 27) is formed of a closable pressure chamber (22)
being in connection with the service pressure chamber (7),
and of an operating piston (27) delimiting the pressure
chamber (22) and being preloaded by means of a spring
assembly (28), said operating piston cooperating with the
spindle (16) in such a fashion that, after decrease of the
pressure prevailing in the pressure chamber (22), the
force produced by the spring assembly (28) is transmitted
to the spindle (16) in order to thereby cause
disengagement of the friction surfaces (17, 18) of the
locking device.
6. Hydraulic vehicle brake as claimed in claim 5,
c h a r a c t e r i z e d in that the operating piston
(27) has a two-part design, consisting of a first
operating piston part (27a) and a second operating piston
part (27b), and a spring assembly (29) is interposed
between the two operating piston parts (27a, 27b) so as to
allow a movement of the first operating piston part (27a)
relative to the second operating piston part (27b).

7. Hydraulic vehicle brake as claimed in claim 6,
c h a r a c t e r i z e d in that the force generated by the spring assembly (28) is transmitted to the spindle (16) by means of the first operating piston part (27a), while the second operating piston part (27b) has an annular design and radially encompasses the first operating piston part (27a).
8. Hydraulic vehicle brake as claimed in claim 4,
c h a r a c t e r i z e d in that the electromechanical device (35) is formed of an actuating element (31) that is in a force-transmitting connection with the spindle (16), and of a second actuating element (32) operable by means of an electromagnetic arrangement (36), with both actuating elements (31, 32) including interacting slopes (33, 34) or ramps, respectively.
9. Hydraulic vehicle brake as claimed in any one of claims 2 to 7,
c h a r a c t e r i z e d in that there is provision of another spring (19) that is supported on the brake housing (1) and biases the spindle (16) in the direction of the second friction surface (18).
10. Hydraulic vehicle brake as claimed in claim 1,
c h a r a c t e r i z e d in that at least one part (42) of the locking device is arranged in the energy accumulator (10).
11. Hydraulic vehicle brake as claimed in claim 10,
c h a r a c t e r i z e d in that the energy accumulator (10) is formed of a closable accumulator pressure chamber (40) being in connection with the service pressure chamber

(7), and of an accumulator piston (41) delimiting the accumulator pressure chamber (40) and being in a force-transmitting connection with an adjusting ring (42) that is arranged so as to be rotatable within limits, the spring element (12) being supported on the adjusting ring, which is movable into engagement with a spindle (16) that is connected to the brake piston (6) by means of a non-self-locking thread, with the locking device being formed of the adjusting ring (42) and the spindle (16).

12. Hydraulic vehicle brake as claimed in claim 11, characterized in that the adjusting ring (42) includes guiding projections (47) being guided in differently long guiding grooves (48, 49), that are provided in the wall of a housing (52) accommodating the energy accumulator (10) offset in its circumferential direction, and the length of the short guiding groove (48) defines the released position of the locking device, and the length of the longer guiding groove (49) defines the locked position of the locking device.
13. Hydraulic vehicle brake as claimed in claim 1, characterized in that the service pressure chamber (7) is delimited by the brake piston (6) on one side and by an accumulator piston (54, 64, 94) on the other side, on which piston a spring assembly (60, 63, 90) is supported, and a first contact or friction surface (57, 71, 97) and a second contact or friction surface (58, 72, 98) are moved into engagement with each other upon actuation of the locking device, while they are disengaged during release.

14. Hydraulic vehicle brake as claimed in claim 13,
c h a r a c t e r i z e d in that the locking device is
formed of a threaded-nut/spindle assembly whose spindle
(56) is connected to the brake piston (6), while the
threaded nut (55) is provided with a first friction
surface (57) cooperating, in the locked condition, with a
second friction surface (58) provided in the accumulator
piston (54), and an electromagnetic device (62) is
arranged exerting a tension force on a tension-force
transmitting element (61) rigidly connected to the
threaded nut (55) and, thus, causing a rigid locking
engagement between the brake piston (6) and the
accumulator piston (54).
15. Hydraulic vehicle brake as claimed in claim 14,
c h a r a c t e r i z e d in that a non-self-locking
thread is interposed between the threaded nut (55) and the
spindle (56).
16. Hydraulic vehicle brake as claimed in claim 1,
c h a r a c t e r i z e d in that the energy accumulator
(10) is formed of a closable accumulator pressure chamber
(83) connected to the service pressure chamber (7), and of
an accumulator piston (84) delimiting the accumulator
pressure chamber (83), with the connection between the
service pressure chamber (7) and the accumulator pressure
chamber (83) being closable by means of a mechanically
operable separating valve (77).
17. Hydraulic vehicle brake as claimed in claim 13 or 16,
c h a r a c t e r i z e d in that the locking device is
provided by a threaded-nut/spindle assembly, whose spindle
(66, 76) is driven by an electric motor (69, 79), while

the threaded nut (65, 75) has a first contact surface (71, 81) that cooperates, in the locked condition, with a second contact surface (72, 82) designed in the brake piston (6).

18. Hydraulic vehicle brake as claimed in claims 16 and 17, characterized in that a self-locking thread is provided between the threaded nut (65, 75) and the spindle (66, 76).
19. Hydraulic vehicle brake as claimed in claims 16 and 17, characterized in that the separating valve (77) is operable by the threaded nut (75).
20. Hydraulic vehicle brake as claimed in any one of claims 16 to 19, characterized in that a second connection is provided between the service pressure chamber (7) and the accumulator pressure chamber (83), in which a non-return valve (78) opening towards the service pressure chamber (7) is inserted.
21. Hydraulic vehicle brake as claimed in claim 2 or 11, characterized in that the hydraulic pressure chamber (22) and the accumulator pressure chamber (40), respectively, is closable by means of an electrically operable valve (24, 45).
22. Hydraulic vehicle brake as claimed in claim 1 or 13, characterized in that an arresting unit (91) is provided which maintains the energy accumulator (10) in its charged condition during service brake operations.

23. Hydraulic vehicle brake as claimed in claim 22,
c h a r a c t e r i z e d in that the arresting unit
(91) is formed of at least one electromagnet (95) whose
coil (89) fulfils the function of a sensor for sensing the
position of a slide (93) actuated by the armature (92) of
the electromagnet (95).
24. Hydraulic vehicle brake as claimed in claim 23,
c h a r a c t e r i z e d in that the coil (89) fulfils
the function of a sensor for monitoring the pressure
introduced into the service pressure chamber (7) and/or
for detecting the condition of the vehicle brake or the
parking brake device.
25. Hydraulic vehicle brake as claimed in claim 22,
c h a r a c t e r i z e d in that the arresting unit
(91) is formed of at least two electromagnets (95, 105),
whose armatures (92, 102) act upon the slide (93), and the
coil (89) of the first electromagnet (95) actuates the
slide (93), while the coil (109) of the second
electromagnet (105) fulfils the function of a sensor for
detecting the slide position.
26. Hydraulic vehicle brake as claimed in claim 25,
c h a r a c t e r i z e d in that the coils (89, 109)
fulfill the function of a sensor for detecting the slide
position, unless they fulfill the function of an actuator
for actuating the slide (93).
27. Hydraulic vehicle brake as claimed in claim 22,
c h a r a c t e r i z e d in that the arresting unit
(91) is formed of at least one piezoelectric actuator
(103) that actuates a slide and detects its position.

28. Hydraulic vehicle brake as claimed in claim 27,
c h a r a c t e r i z e d in that the piezoelectric
actuator (103) fulfils the function of a sensor for
monitoring the pressure introduced into the service
pressure chamber (7) and/or for detecting the condition of
the vehicle brake or the parking brake device.
29. Hydraulic vehicle brake as claimed in any one of claims 2,
11 or 22,
c h a r a c t e r i z e d in that a means (30) is
provided for releasing the parking brake in a case of
emergency, said means cooperating with the operating
piston (27) or the accumulator piston (41, 94),
respectively.
30. Hydraulic vehicle brake as claimed in any one of the
preceding claims,
c h a r a c t e r i z e d in that the pressure buildup
both in the service pressure chamber (7) and in the
hydraulic pressure chamber (22) or the accumulator
pressure chamber (40), respectively, takes place by means
of a hydraulic pump which is used as an independent
pressure source of an electrohydraulic brake system.
31. Hydraulic vehicle brake as claimed in any one of the
preceding claims 1 to 29,
c h a r a c t e r i z e d in that the pressure buildup
both in the service pressure chamber (7) and in the
hydraulic pressure chamber (22) or the accumulator
pressure chamber (40), respectively, takes place by means
of a pressure generator operable by the vehicle operator.